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Honne Oil Biodiesel – Alternative Fuel for CI Engine

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ABSTRACT

Now a days alternative source of energy are given importance due to gradual depletion of fossil fuels reserves. The use of vegetable oils in CI engine results in low CO and HC emissions compared to conventional diesel fuel. The present study covers the preparation of biodiesel from honne oil by converting to honne oil methyl esters (HOME) by transesterification process. The properties of biodiesel are compared with diesel. From the comparison of properties, it is inferred that the biodiesel prepared can be used as alternative fuel for CI engine without any engine modification. The findings of the present research work infer that the biodiesel obtained from honne oil is a promising alternative fuel for direct-injection four-stroke CI engine.

Keywords: Biodiesel, Honne Oil, Properties, Alternative Fuel, CI Engine

I. INTRODUCTION

The twenty-first century introduced an era of increased global petroleum demand that has not been met with an increase in oil production. The most practical and least disruptive strategy to achieve the objective of lowering dependency on petroleum is to use alternative fuels. Biodiesel is a diesel fuel alternative produced from oil seeds, primarily soy, and can be grown and produced domestically.

Among the many alternative fuels biodiesel are considered as a most desirable fuel extender and fuel additive due to its high oxygen content and renewable in nature. Alternative fuel termed as Biodiesel is obtained from non-edible oil seeds, vegetable oil, and Animal fats. Chemically biodiesel is referred as mono-alkyl esters of long chain fatty acid derived from renewable biological sources. It can be directly used in the compression ignition engine. Biodiesel fuel is a clean burning alternative fuel that comes from 100% renewable resources. Many people believe that Biodiesel is the fuel of the future. Sometimes it is also known as Bio-fuel. Biodiesel does not contain petroleum, but petroleum can be mixed to produce a biodiesel blend that can be used in many different vehicles. Pure biodiesel fuel though, can only be used in diesel engines. Biodiesel is biodegradable and non-toxic.
The main objective of this work is to analyze the properties of biodiesel produced from 'Honne Oil' with diesel fuel, which will help in the direction of search of alternative fuel for CI engines.

Figure 1.1, shows the oil yield of various oil sources for biodiesel feedstock Palm oil has potential of high productivity (litres per hectare) when compared to other vegetable oils. As the figure shows, the highest oil productivity of palm oil is about 5950 litres per hectare which is about 13 times better than soybean oil and follows by Honne oil.

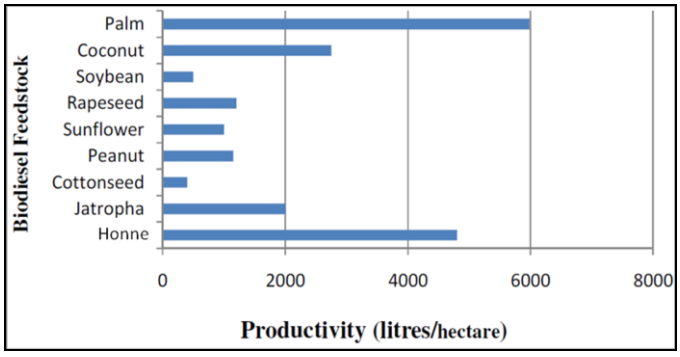

Figure 1.1. The oil yield of various oil sources for biodiesel feedstock Palm oil has potential of high productivity

II. METHODS AND MATERIAL

Honne oil contains 19.58% free fatty acids. The methyl ester is produced by chemically reacting honne oil with an alcohol (methyl), in the presence of catalyst (Sodium Hydroxide). A two stage process is used for the transesterification of honne oil.

The first stage (acid catalyzed) of the process is to reduce the free fatty acids (FFA) content in oil by esterification with methanol (99% pure) and acid catalyst sulfuric acid (98% pure) in one hour time at 57ºC in a closed reactor vessel. The oil is first heated to 50ºC then 0.7% (by wt. of oil) sulfuric acid is to be added to oil and methyl alcohol about 1:6 molar ratio (by molar mass of oil) is added. Methyl alcohol is added in excess amount to speed up the reaction. This reaction was proceeding with stirring at 650 rpm and temperature was controlled at 55-57ºC for 90 min. The fatty ester is separated after natural cooling.

At second level, the separated oil from the separating funnel has to undergo transesterification. Methoxide (methanol + sodium hydroxide) is added with the above ester and heated to 65°C. The same temperature is maintained for 2 hr. with continuous stirring, and then, it undergoes natural cooling for 8 hr. Glycerol will deposit at the bottom of the flask, and it is separated out by a separating funnel. The remnants in the flask are the esterified vegetable oil (biodiesel).

The separated biodiesel from the above-mentioned method contains various impurities like traces of glycerol, unused methanol, soap particles, etc. Water washing is carried out to remove all impurities. Air bubble wash is one of the methods normally recommended in the laboratory level. In this method, the impure biodiesel is placed in a beaker initially. Water is added slowly through the side wall of the beaker (both are immiscible). It is ensured that the equal amount of water is added above the level of biodiesel. Air is made to pass through the biodiesel and the water from the bottom of the beaker with the help of a bubbler (electrically operated).

The air will then take away all impurities from the biodiesel; they will move up as the bubbles move up, and they are added in the water. The unused methanol will be diluted in water. The traces of glycerol and soap particles make the water to become like soap water. Once the water becomes like soap water, the bubbler is stopped. After allowing some time for impurities to settle, the biodiesel is drained from the separating funnel, and pure biodiesel will be directly used, with or without blending, in the engine.

III. RESULTS AND DISCUSSION

Diesel, Honne Oil and Biodiesel-Honne Oil Methyl Ester (HOME) are tested for their properties as per the standards IS-1448, the test result tabulated as below,

TABLE I
PROPERTY TABLE

Parameter	*Test Standard*	*Diesel*	*HOME*	*Honne Oil*
Density at 15ºC (gm/cc)	IS 1448 (P16) 2007	0.835	0.8653	0.9363
Kinematic Viscosity at 40ºC (cst)	IS 1448 (P25) 2007	3.5	1.744	51.58
Calorific Value (MJ/Kg)	IS 1448 (P6) 2007	43.00	35.37	40.27
Flash Point (ºC)	IS 1448 (P69) 2013	44	8.5	220

A. Density at 15˚C in gm/cc

Lab reports shows, density of diesel and biodiesel (HOME) are approximately equal, hence biodiesel shows no problem in storage capacity, flow pipe section and other related issues in compared to diesel.

B. Kinematic Viscosity at 40˚C in cst

Lab reports shows, kinematic viscosity of biodiesel (HOME) is lower than diesel fuel, hence biodiesel will show good fluidability characteristics and easily atomize to fine particles, hence better mixing with combustion air which help to improve combustion.

C. Calorific Value in MJ/Kg

Lab reports shows, calorific value of biodiesel (HOME) is lower than diesel fuel, which directly affect the heat liberated in combustion of biodiesel fuel, thus lower the power output. These can be improve by dopes and additive whose impact on power output is needed to be studied.

D. Flash Point in ˚C

The flash point of a volatile material is the lowest temperature at which it can vaporize to form an ignitable mixture in air.

Lab reports shows, flash point value of biodiesel (HOME) is lower than diesel fuel, which improve the formation of air – fuel vapour mixture, which result into homogeneous combustion of biodiesel fuel.

IV. CONCLUSION

The conclusion of present work is,

1. Successfully biodiesel is prepared from the Honne Oil by transesterification process.
2. The properties of biodiesel produces matches the properties of diesel fuel, so that we can use it in replacement of diesel, the extend of blend proportion is to be studied.
3. The properties of raw Honne oil shows that direct used of honne oil is not possible to used in engine due to major problem of its higher viscosity, the preheating to reduced viscosity and then direct use of honne oil is to be studied.
4. The biodiesel thus produced can be used as alternative fuel to CI Engine as per properties, the experimental validation is to be studied.

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